Appendix G
Case Studies

❑ Case Study #1 - Lab Eliminates Mercury Stains

The Department of Veterans Affairs Medical Center in Albuquerque has found a way to eliminate mercury and reduce chemical usage. Hematoxylin stain is one of the primary stains used by the histology lab to stain tissue for microscopic examination. Prior to 1993, the histology lab was using 5 liters per month of hematoxylin stain that contained 2.5 grams per liter of mercuric oxide (red). Mercuric oxide has traditionally been added to hematoxylin stain to act as an oxidizing agent.

This laboratory switched to a non-mercury alternative called Harris' Alum Hematoxylin. This stain contains hematoxylin, absolute ethyl alcohol, aluminum ammonium sulfate, distilled water and sodium iodate as the oxidizing agent instead of mercuric oxide. The laboratory has found this stain to be more stable and longer lasting than the mercury containing stain. This has resulted in the use of hematoxylin stain at a rate of only 4 liters per month for a savings of one liter per month of stain and the elimination of mercury.

The laboratory makes the Harris' Alum Hematoxylin stain in house. The laboratory set an initial goal of eliminating mercury from it's lab. This laboratories efforts have paid off well because it has successfully found a substitute that actually preforms better than the mercury stain. The substitute has added advantages in that it reduces employee's possible exposure to mercury and can be safely disposed of down the drain without anymore mercury being introduced into the environment.

❑ Case Study #2 - Lab Reduces Bouin's and B-5 Fixative Usage by over 70%

Simple process changes can have significant results on waste reduction. The histology laboratory at the Albuquerque Veterans Administration Hospital implemented simple changes that achieved significant pollution prevention results and saved the usage of chemicals and generation of wastes. The lab reduced it's use of Bouin's solution by 75% and it's use of B-5 fixative by 70%. Bouin's solutions is made in-house and contains picric acid, 37% formaldehyde, and glacial acetic acid. Glacial acetic is very caustic, flammable, and is an irritant. Picric acid is caustic and is explosive when dry. 37% formaldehyde is corrosive and is a known carcinogen. The B-5 fixative contains mercuric chloride, sodium acetate, distilled water, and 37% formaldehyde.

The histology lab supplies the hospital clinics with Bouin's fixative to preserve small tissue biopsies for microscopic evaluation. The lab used to supply containers with a capacity of 30 cc and that were filled with 20 cc of Bouin's solution. The lab switched to using containers with a capacity of 7 cc and filled them with 5 cc of Bouin's solution. At the current workload the lab would have used 5.3 liters per month of Bouin's but because of this process change it now only uses 1.3 liters per month for a 75% reduction in the use of Bouin's fixative.

The lab also provided containers with a capacity of 100 cc that were filled with 50 cc of B-5 fixative. The lab switched to using containers with a capacity of 20 cc filled with 15 cc of B-5 fixative. The laboratory now saves a total of 350 ml per month of B-5 fixative. A waste reduction of 70% was achieved by switching to the use of smaller speciment containers.

The criteria used for transition to the smaller containers was that a 10:1 ratio of fixative to speciment was to be maintained. The Bouin's and B-5 fixatives are used for small biopsies which do not require large volumes of fixatives.

Advantages of Switching to Smaller Specimen Containers:
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- Reduced chemical waste
- Reduced costs of reagents
- Reduced costs of containers
- Reduced employees' possible exposure to toxic chemicals

❑ Case Study #3 - Lab Saves 39,000 Gallons Per Year of Water and Reduces Xylene Use

The histology laboratory at the Albuquerque Veterans Administration Hospital is using a distillation unit from B/R Instrument Company to recycle it's waste xylene. The still is designed to use running tap water to cool a condenser element which condenses fumes into liquids. The still was using tap water that cycled through the condenser once and then was discarded down the drain. A water recycling water chiller unit was installed that closed the loop on water and eliminated the need for tap water. The water recycling unit was found in the hospital as surplus equipment. Resourceful staff at the VA Hospital hooked up the water recycler to the B/R distillation unit which eliminated the need for tap water.

Water Savings: The lab is saving about 750 gallons of potable water per week or 39,000 gallons per year.

The amount of xylene being used in the cytology lab has been reduced by one liter per week by using xylene substitutes. The cytology lab is using a d'limonene xylene substitute called Americlear Clearing Solvent (Stephens Scientific). The laboratory has also eliminated 250 ml of xylene in the frozen section room by using a blend of aliphatic hydrocarbons (Shandon Lipshaw) instead of xylene.

To further improve xylene recovery in the labs' on-site xylene still, the laboratory changed the quality of xylene it purchased. The laboratory switched to solvent of a lower quality that is histology grade but that has been previously used and redistilled. Staff at the laboratory found that using a lower grade of xylene actually improved the amount of xylene recovery after distillation. The use of different xylene quality has increased the amount of xylene that is recovered thus leading to cost savings due to a reduction in waste disposal and raw material purchases.

❑ Case Study #4 - Lab Reduces Gluteraldehyde Use by 80%

The histology laboratory at the Albuquerque Veterans Administration Hospital uses a 5 percent solution of glutarldehyde to fix lung tissue during the performance of postmortem examinations. The laboratory has reduced it's use of gluteraldehyde by posing the question "why do we use this chemical". Sometimes the answers can lead to significant break throughs in waste reduction as happened in this case. The lab was able to reduce the use of gluteraldehyde by simply eliminating it's use in the process whenever possible.

The gluteraldehdye solution contains 25% gluteraldehyde, sodium acetate, and distilled water.

Waste Reduction: Use of gluteraldehyde has been reduced from 10 liters per month to 2 liters per month for this application.

Advantages:

- Reduced chemical waste
- Reduced cost of reagents
- Reduced cost of containers
- Reduced employee's possible exposure to toxic chemicals

Disadvantages

- Some pathologists feel that lung tissue fixed with glutaraldehyde is superior to other methods.

❑ Case Study #5 - Lab Recycles Xylene and Alcohol

S.E.D. Medical Laboratories has reduced material purchasing costs and reduced wastes by recycling xylene and alcohol since 1986. A distillation unit is being used to recycle xylene and alcohol from the histology and cytology staining processes. The benefits of recycling are cost savings, waste reduction and the recycled product is of higher quality than the original material.

Xylene and alcohol are run in batch sizes of 12.25 liters. The xylene is run for a duration of 6 to 7 hours and the alcohol from about 12 to 16 hours and a recovery rate of about 80% is achieved. The still bottoms are managed and disposed of as hazardous waste. The still has a water recycling feature for the cooling water supply which is saving thousands of gallons of water every year.

Capitol Cost of Still: $14,000
Operating Cost of Still: $1302 per year
Still Manufacturer: B/R Instruments Corporation

Cost Savings due to Recycling: $15,560 per year after payback on still

Payback Period: Eleven Months

Waste Reduction: 173 gallons per year of xylene
228 gallons per year of alcohol

❑ Case Study #6 - Laboratory Eliminates Mercury from Chemistry

Drug Detection Services Inc., a forensic drug testing laboratory eliminated hazardous mercury wastes by selectively choosing the type of chemistry used in it's laboratory with pollution prevention in mind. The laboratory runs immunoassay testing on urine for detection of illicit drugs and drugs of abuse. The options that were available included radioimmuno assay (RIA) tests that generate radioactive waste, testing (EMIT) that utilizes mercury as a stabilizer.

The alternative chemistry being used is Microgenics. The Microgenics chemistry does not produce radioactive or mercury bearing waste. None of the controls, standards, or calibrators use mercury as a stabilizing agent. The use of the Microgenics chemistry has eliminated the disposal and employee hazards associated with handling and disposing of mercury and radioactive wastes. In fact, the laboratory has found that this alternative chemistry has greater sensitivity and specificity than the other methods.